JOINTING LINE WIRES.

1. REQUIREMENTS OF JOINT.

1.1 The requirements of an ideal joint are as follows -

(i) It should be capable of being made speedily and simply.
(ii) It should not reduce the over-all strength of the wire.
(iii) The insertion of the joint should not affect the electrical resistance of the line, otherwise a series of joints in one wire of a pair would cause resistance unbalance.
(iv) It should not differ in mass from the wire itself, otherwise it is liable to form a reflecting point for vibrations caused by the wind, and fatigue conditions will set up resulting ultimately in a wire breakage.

1.2 Types of Joint.

(i) Twist Sleeve Joint. This joint is made by inserting the ends of the two wires to be jointed through the full length of an oval sleeve, applying a clamp at each end and twisting the sleeve and wires. Three and a half (3-1/2) complete turns are given to the sleeve.

The average strength of these joints is 87 per cent. of the wire strength. These sleeve joints are more liable to develop failures of the line wires than the press type joints, due to their comparatively heavy mass and the need for every care to obtain a straight uniform twist and to avoid any mechanical damage to the wire. The failure in these cases occurs at the end of the sleeve and is accelerated by the tendency to corrode at this point. The resistance of these joints is usually less than that of plain wire. Twist type sleeve joints are to be used only for jointing 400 lb. G.I. and 400 lb. and 600 lb. H.D.C. wire.

✱ (ii) Press Type Joint. The press type sleeve consists of a single copper tube indented at the centre so that the wires can be inserted only so far, the interior being coated with a granular deposit of Monel Metal. The joint is made by inserting the two wires to be jointed into the press type sleeve until each end meets the centre stop. The sleeve is then compressed four or more times in a special tool, which applies a pressure of about 2,000 lb. When the sleeve is squeezed on to the wire, the granules of Monel Metal, being harder, bite into the sleeve and wire forming a friction joint. The compressions are made alternately at 180° to each other so that the sleeve will not bow.

The average strength of a press type joint is 97 per cent. of the wire strength. The mass of the sleeve is less than that of a twist type sleeve and, consequently, these joints are less liable to fatigue trouble. The electrical resistance is reasonably constant and closely approaches the resistance of plain wire.

Press type sleeves are to be used for jointing all sizes of aerial line wire up to and including 200 lb. G.I. and 300 lb. H.D.C.

Table 1 indicates the sleeve and clamping tool used to joint each size of line wire. Each press type sleeve is branded with the title of the sleeve or marked with an identifying colour band.

(iii) Britannia Joint. This joint is made by laying the ends of the wires to be jointed side by side, and wrapping with binding wire. The middle of the binding wire is applied to the centre of the joint, and the ends of the binding wire are wrapped in opposite directions around the two wires, leaving, every five turns, a gap equal to the thickness of the binding wire, finishing off with five turns around the single line wire. The joint is then soldered along the length of the overlap.
The Britannia joint is only used to joint old heavy gauge galvanised iron wire, and, in an emergency, any galvanised iron wire, when supplies of sleeves and/or jointing clamps are not available, such as during bush fires or floods, etc., in remote areas.

The Britannia joint is not to be used for jointing hard drawn copper and cadmium copper wire.

Wire	SLEEVE					TOOL		
	Serial	Item	Description	Colour of Band Press Type	Ext. Diam.	Serial	Item	Description
40 lb. C.C.	64	41	Press Type C.C.40	Nil	1/8"	93	23	Clamp jointing Press Type 40
70 lb. C.C.	64	42	Press Type C.C.70	Green (Lt.)	3/16"	93	24	Clamp jointing Press Type 70/200L
70 lb. H.D.C.								
100 lb. H.D.C.	64	43	Press Type C.100	Red	3/16"			
118 lb. C.C.	64	44	Press Type C.C.118	Blue (Dk.)	7/32"	93	24	Clamp jointing Press Type 70/200L.
150 lb. H.D.C.	64	45	Press Type C.150	Orange	7/32"	93	21	Clamp jointing Press Type 118/300
200 lb. H.D.C.	64	46	Press Type C.200L	Black	7/32"			
200 lb. H.D.C.	64	47*	Press Type C.200H	White	1/4"	93	21	Clamp jointing Press Type 118/300
237 lb. C.C.	64	48	Press Type C.C.237	Grey	1/4"			
262 lb. H.D.C.	64	49	Press Type C.262	Blue (Lt.)	1/4"			
300 lb. H.D.C.	64	50	Press Type C.300	Yellow	1/4"			
200 lb. G.I.	64	52	Press Type G.I.200	Nil	1/4"			
400 lb. H.D.C.	64	5	Twist Type C.400	Nil	-	93	3	Clamp jointing Large 237/600
600 lb. H.D.C.	64	3	Twist Type C.600	Nil	-			
400 lb. G.I.	64	25	Twist Type G.I.400	Nil	-			

* No further purchase being made.

SLEEVE AND CLAMPING TOOLS USED TO JOINT LINE WIRES.

TABLE 1.

2. INSTALLATION - GENERAL.

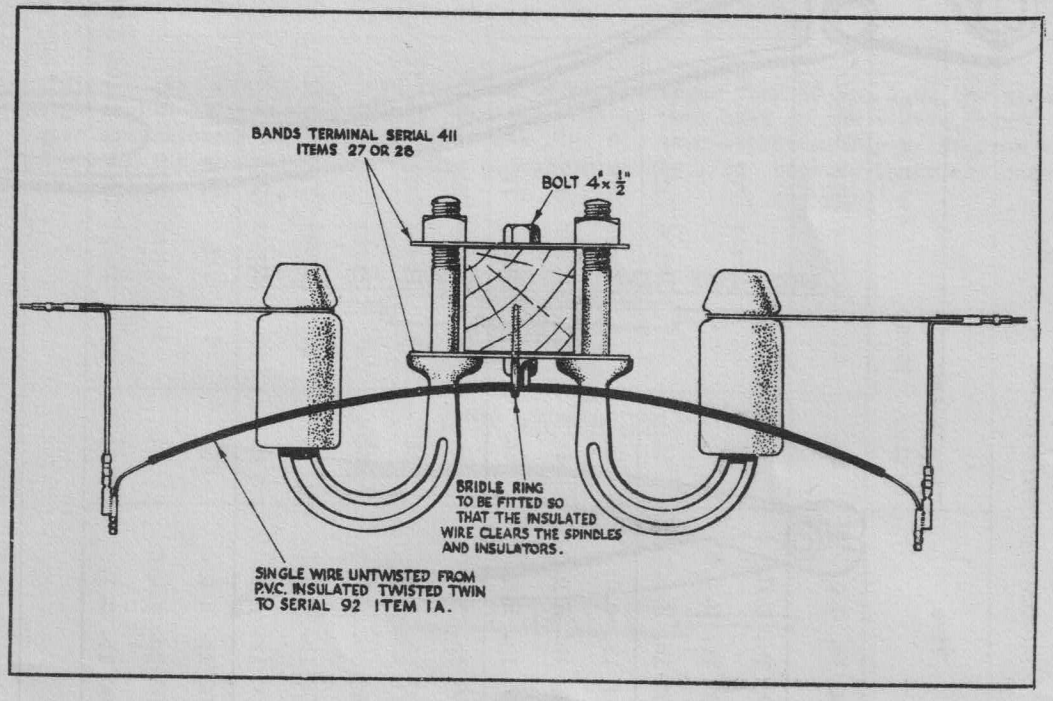
2.1 General. A joint in a line wire is a potential source of trouble and, unless it is well made, it will provide a point of concentration of fatigue and corrosion of the line wire. It is important, therefore, to exercise the greatest care during all jointing operations and, further, to keep the number of joints to a minimum. Particular care should be taken to ensure a straight joint free from any deformity or mechanical damage to the sleeve or wire.

In making a joint, it is essential that the correct sleeve and jointing tool be used. The sleeves must be kept free from dirt and grease, and should not be removed from their package until required for use.

2.2 Positions of Joints. When new joints are being made in existing wires (in connection with re-regulating, shifting or repairs), opportunity should be taken to cut out existing joints where possible. To facilitate this, joints should be, as far as practicable, within the reach of a man on a pole, but not within 18" of an insulator.

In the case of cheaply constructed lines using tree slings, the joints should be sufficiently out in the span between tree slings to permit the wire to run through the barrel insulators should timber fall across the line.

✱ 2.3 Jointing Wires of Different Gauge or Type. Line wire of different gauges or of different materials shall not be joined in a span. Where it is necessary to join two such wires, each wire should be terminated on "J" spindles on terminal bands. The terminations should then be bridged by a length of O.D. wire (Serial 92, Item 1A untwisted) as shown in Fig. 1. Care should be taken to fit the bridle ring so that the O.D. wire clears the spindles and insulators.



JOINTING WIRES OF DIFFERENT TYPE OR GAUGE.

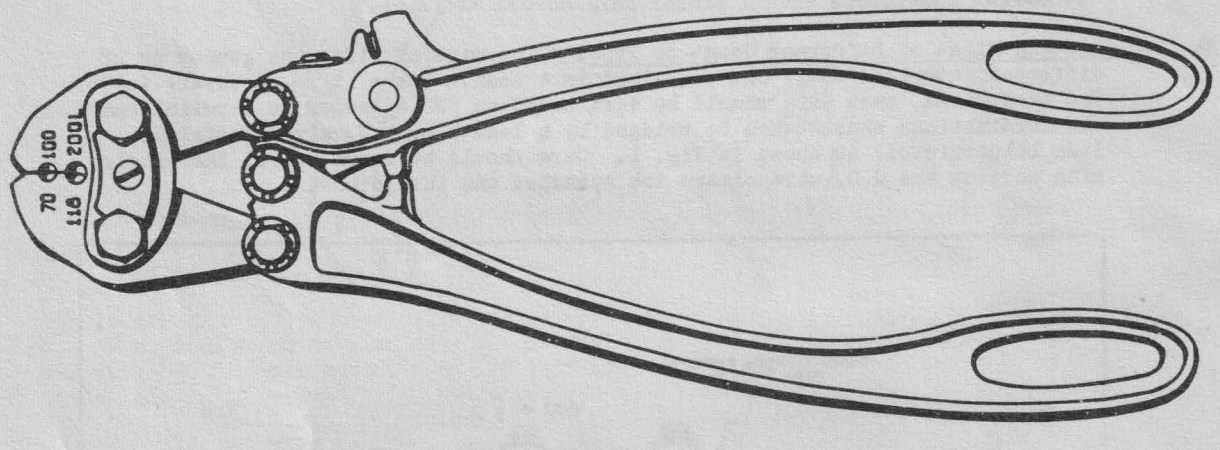
✱ FIG. 1.

3. JOINTING LINE WIRES UP TO 300 LB. PER MILE.

3.1 General. Press type joints are used for jointing all classes of wires of gauge up to 300 lb. per mile.

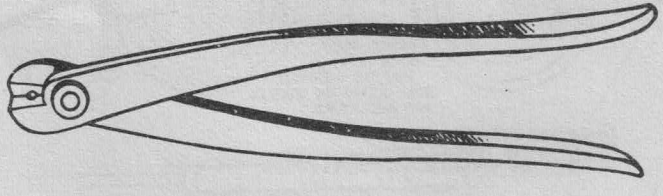
3.2 Sleeves and Tools. The appropriate sleeve for each size and type of wire, and the tools to be used for compressing press type sleeves, are indicated in Table 1. The two main types of tool are shown in Figs. 2 and 3. Tools of the type shown in Fig. 2 are made with two different sets of jaws. One set of jaws has grooves for 3/16" and 7/32" sleeves for wires of gauges from 70 lb. to 200 lb., and the other set has grooves for 7/32" and 1/4" sleeves for wires of gauges from 118 lb. to 300 lb. The tool shown in Fig. 3 is used for jointing 40 lb. C.C. wire.

The maintenance and adjustment of these tools is dealt with in Lines Engineering Instruction, Aerial TE 5842.



PRESS TYPE JOINTING CLAMP 70/200L AND 118/300.

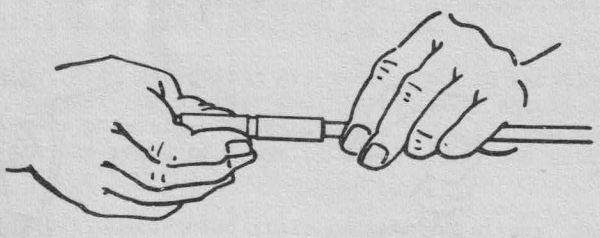
FIG. 2.



PRESS TYPE JOINTING CLAMP 40.

FIG. 3.

3.3 Method of Making Joints. The ends of the wires to be jointed should be straight and, if necessary, cleaned with emery cloth No. 1 (both new and old wire) and any burrs removed. The ends of the wires should then be inserted into the sleeve from either end until they reach the centre stop. (See Fig. 4.) If they will not go right in, remove and clean again. The wires should not be twisted in the sleeve, as this tends to remove the granules in the film of sprayed metal.



INSERTING WIRE INTO SLEEVE.

FIG. 4.

In order to hold the wires in position while the joint is completed, the sleeve should be pinched lightly with cutting pliers on each side of the centre. The sleeve should then be compressed using the correct groove in the appropriate clamping tool. The range of sleeves to be associated with a groove is engraved on the jaws of each tool opposite the groove.

3.4 Jointing Wires Over 40 lb. In the case of wires larger than 40 lb. C.C. the sleeve is given two compressions with a jointing tool on each half of the sleeve, the inner compressions being made first (see Fig. 5), each approximately 1/16" from the centre of the sleeve. There should be approximately 1/16" between inner and outer compressions (see Fig. 6).

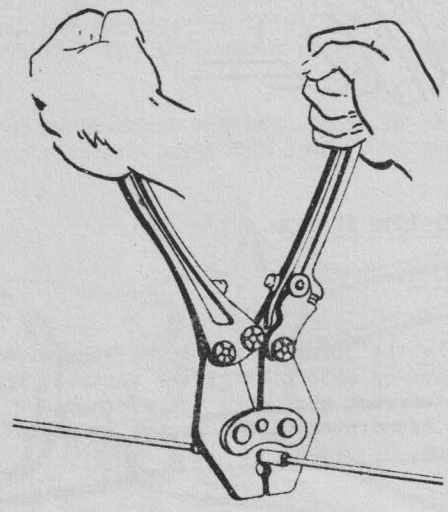
INNER COMPRESSIONS.

FIG. 5.

OUTER COMPRESSIONS.

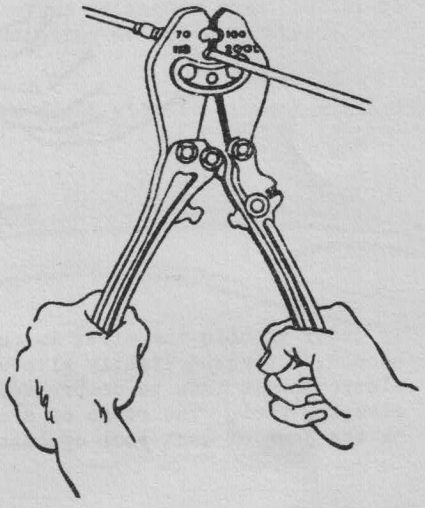
FIG. 6.

Adjacent compressions should be made with the handles of the jointing tool on opposite sides of the sleeve. (See Figs. 7 and 8.) The fins resulting from the compressions should be in line. The jointing clamp should be operated by opening the handles fully, placing the tool so that the sleeve is between the correct grooves, with the handles at right angles to the line wire, and closing the handles until the handle stops meet.



MAKING THE COMPRESSION ON ONE SIDE.

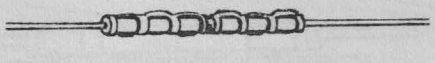
FIG. 7.



MAKING THE COMPRESSION ON THE ADJACENT SIDE.

FIG. 8.

3.5 Jointing of 40 lb. C.C. Wire. In the case of 40 lb. C.C. wire, the sleeve is given three compressions on each half of the sleeve, the inner compressions being made first. The resilience of the handles of the jointing clamp will indicate when the fullest possible pressure has been applied. Again, adjacent compressions should be made with the handles of the jointing tool on opposite sides of the sleeve to prevent bowing of the sleeve. (See Fig. 9.)



THREE COMPRESSIONS ON EACH HALF OF SLEEVE.

FIG. 9.

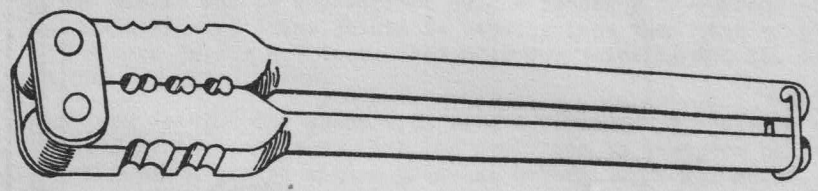
4. JOINTING LINE WIRES OVER 300 LB. PER MILE.

4.1 General. Twist type sleeve joints are to be used for jointing wires of heavier gauge than 300 lb. per mile, that is, for 400 lb. G.I. and 400 lb. and 600 lb. H.D.C. wire, except in the case of old 400 lb. or larger G.I. wire (the surface of which has become corroded), for which a Britannia joint should be used. The Britannia joint may also be used in an emergency on any G.I. wire, when supplies of sleeves and jointing tools are not available, such as in remote areas during bush fires or floods. Britannia joints must not be used on copper wires.

4.2 Sleeves. The appropriate sleeve for each size of wire is indicated in Table 1.

4.3 Jointing Tool. The tool to be used for jointing line wire of heavier gauge than 300 lb. per mile is a Clamp, Jointing, Large 237/600. (See Fig. 10.)

Pliers should on no account be used for twisting sleeve joints.

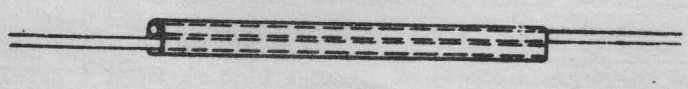


CLAMP, JOINTING, LARGE 237/600.

FIG. 10.

4.4 Method of Making Twist Sleeve Joint. Those portions of the wires to be jointed which will be within the sleeve should be straightened, if necessary, and thoroughly cleaned using emery cloth No. 1. In the case of Galvanised Iron wire, care should be exercised to avoid injury to the galvanising. In order to ensure that the joint will have good electrical conductivity, it is essential that new, as well as old, wire be cleaned. New wire, although it appears bright and clean, may possibly be covered with an oil film. After cleaning the wire, remove the dust, etc., from the wire by wiping it with a rag or other available cloth.

The wires should then be inserted in the sleeve from opposite ends, so that the ends of the wires project about 1/16" at each end. (See Fig. 11.)

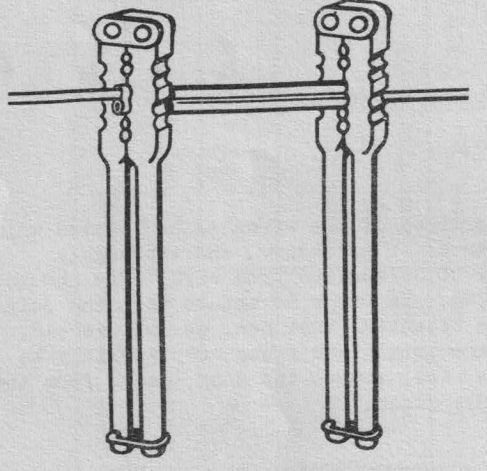


TWIST TYPE SLEEVE ON WIRES.

FIG. 11.

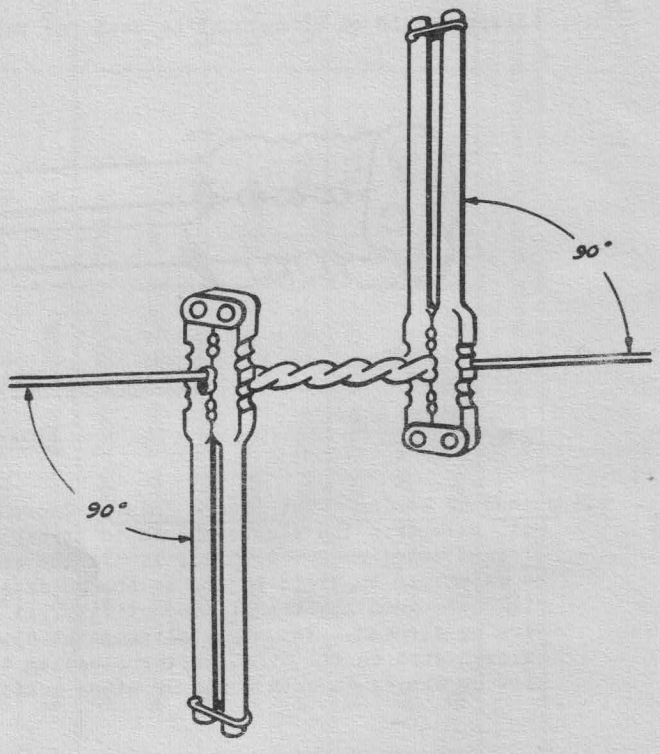
Place the Jointing Clamps in positions, so that the edges of the clamps are approximately 1/8" from the ends of the sleeve. Care should be taken to select the groove in the clamp intended for the particular size of sleeve being used. (See Fig. 12.)

The sleeve is now twisted by holding one of the jointing clamps and rotating the other, 3-1/2 complete revolutions. (See Fig. 13.) When the joint is made near a termination, the clamp furthest therefrom should be rotated. Care must be taken to keep the two clamps at right angles to the line wire, and to keep sleeve and line wire straight throughout the operation, otherwise a crooked joint will result.



JOINTING CLAMPS IN POSITION BEFORE TWISTING.

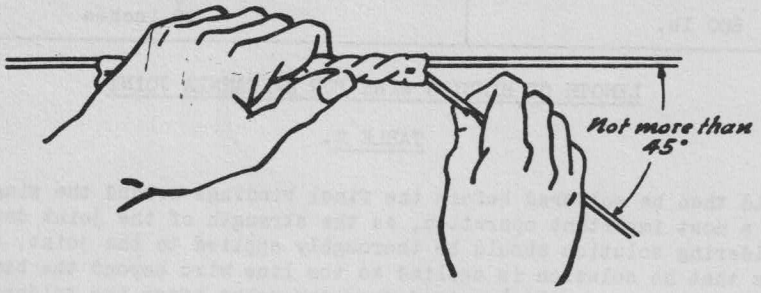
FIG. 12.



MAKING THE TWIST.

FIG. 13.

If the wires being jointed are under tension, such as when held in grips, the end of one wire only should protrude from the end of the sleeve to avoid the need for breaking off more than one protruding end. After the sleeve has been twisted, the protruding end of wire should be removed by firmly holding the sleeve in one hand, and bending the end of the wire to be removed backwards and forwards until the wire breaks. In the case of iron wire, a small nick should first be made at the desired breaking point. (See Fig. 14.)

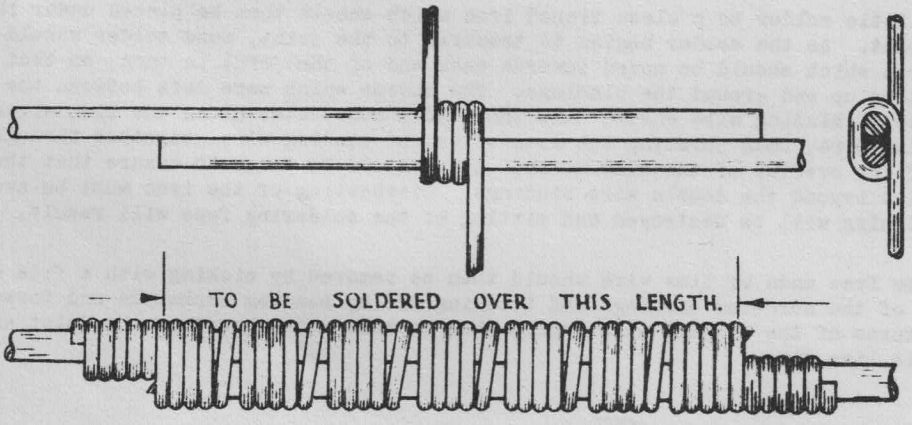


BREAKING OFF THE WIRE.

FIG. 14.

4.5 Method of Making Britannia Joints. The ends of the G.I. wires to be jointed should be perfectly straight and thoroughly cleaned with emery cloth No. 1. 60 lb. G.I. wire should be used as binding wire, which should also be cleaned with emery cloth. The two cleaned ends of line wire should be laid side by side, with, if practicable, at least 9" overlap to facilitate the removal of the surplus line wire after the completion of the joint.

In the case of 600 lb. and larger wire, a small gauge G.I. wire should be placed in the grooves between the two line wires to fill the space which would otherwise exist between the line wires and the binding wire. The binding wire should then be passed around the line wires at the centre of the proposed joint, the free ends of the binding wire being of equal lengths. The two free ends of the binding wire should be wound around the two line wires in opposite directions. Every 5 turns, a space equal to the thickness of the binding wire should be left between the turns. Seven complete groups of 5 turns should be made, as shown in Fig. 15. The length of binding wire to be used is given in Table 2.



BRITANNIA JOINT.

FIG. 15.

Gauge of Line Wire	Length of Binding Wire Required
200 lb.	42 inches
400 lb.	54 inches
600 lb.	60 inches

LENGTH OF BINDING WIRE FOR BRITANNIA JOINT.

TABLE 2.

The joint should then be soldered before the final bindings around the single wire are made. This is a most important operation, as the strength of the joint depends on the soldering. Soldering solution should be thoroughly applied to the joint, care being taken to ensure that no solution is applied to the line wire beyond the bindings. Any surplus soldering solution should be wiped from the joint after the soldering has been completed. Excessive use of solution must be avoided.

The soldering should be done with a 2 lb. soldering iron and 50/50 solder. A new untinned soldering iron should be tinned as follows -

(i) Heat the iron well (that is, until solder readily melts thereon) and, while hot, file the face to give a clean bright surface.

(ii) Reheat if necessary, and apply resin cored solder to the cleaned surface. The solder should immediately flow freely, wetting the cleaned surface.

(iii) If resin cored solder is not available, use 50/50 solder on the surface of a piece of sal ammoniac, the hot iron being rubbed in the molten solder over the face of the sal ammoniac. Alternatively, soldering solution or paste on a clean tinned surface may be used instead of the sal ammoniac.

After an old iron, which has become pitted or dirty, has been heated thoroughly to remove the tinning and filed to give a clean flat surface, treat it similarly to a new untinned iron.

Apply a little solder to a clean tinned iron which should then be placed under the centre of the joint. As the solder begins to transfer to the joint, more solder should be applied to the iron which should be moved towards each end of the joint in turn, so that the solder flows up and around the bindings. The spaces which were left between the groups of 5 turns of binding wire ensure that the solder penetrates along the line wires beneath the binding wire, thus jointing the line wires and binding wire together throughout the length of the overlap of the line wires. Care should be taken to ensure that the iron is not applied beyond the double wire bindings. Overheating of the iron must be avoided, as the tinning will be destroyed and pitting of the soldering face will result.

The excess free ends of line wire should then be removed by nicking with a file close to the ends of the soldered bindings and breaking off by bending backwards and forwards. A final 5 turns of the binding wire should then be made at each end of the joint around the single line wire.

END.